Threats to Biodiversity in Arab Countries

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Abstract

Very little thought has been given to threats facing biodiversity in the hot arid regions of the world. This type of environment prevails in the largest part of Arab countries, giving the false impression that their biodiversity must be unimportant. Some people even say: "What is there in deserts that is worth conserving?". Nevertheless, many plant and animal domestications took place in Arab countries and many of the wild relatives of domesticated species still exist in their centres of origin in semi-desert areas. However, these are gradually disappearing as a result of excessive resource exploitation. There are also substantial forests still remaining on the fringes of the Arab World that are threatened with rapid destruction. Many desert plants have medicinal properties that give them a high commercial value, the reason for their uncontrolled collection by traditional herbalists, who know very well how to use them. Much less known is the extra-ordinary physiological diversity of small desert animals, adapted by various mechanisms to heat and drought. They are therefore of high potential value for medicine, such as for the treatment of diabetes and kidney trouble. They, too, are collected by foreign pharmaceutical companies, but destruction of their habitats is even a greater threat for their survival. The most serious threat to larger desert animals is the hunting caravans conducted by West Asians who roam the deserts to shoot everything on sight. The conservation movement is steadily growing, and the press is trying to alert the public about the damage such erosion of biodiversity may cause to human welfare and to the sustainability of development.

National and international efforts for the management and conservation of biodiversity in Arab countries include public awareness through the media,

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scientific meetings, national committees, national and regional strategies, promulgation of laws, research and training, establishment of nature and biosphere reserves. But much more is needed, such as higher levels of taxation for the utilization of wildlife resources (collecting, hunting, etc.), stricter governmental control over these resources, national and regional charters based on similar regional and international charters elsewhere (particularly in Europe), adherence to international agreements (Bonn, Bern, CITES, Ramsar, etc.) as well as intensification of currently on-going activities.

Introduction

To many outside observers, nature conservation in Arab countries, let alone biodiversity conservation, seems an activity not given enough priority in national land-use planning, or in the priorities of international organizations (such as IUCN), and of other environmental groups concerned with these issues. Until 1974, no Arab country was mentioned in the annual *UN List of Nature Reserves and Protected Areas*. Nevertheless, the tradition of nature conservation, or rather conservation of natural resources, is not alien to the Arab culture, as witnessed by the *Hema* system practised in the Arabian Peninsula before and after Islam, the *Ghuta* orchards of Damascus, the oases of Morocco and Andalusia, etc. (Ghabbour, 1975). In modern times, however, the introduction of firearms, and the spirit of profiteering, population pressures, economic aspirations, have destroyed much of the natural heritage in the Arabian environment, be it medicinal plants, trees for charcoal production or game animals. Recently, the oil wealth of west Asians has enticed them into organizing large hunting campaigns to deprive neighbouring countries from whatever wild animal resources they still possess. These different types of ecosystem impoverishment greatly harmed the inception of a nascent environmental movement in the early fifties when people used to exclaim: "What is there in the Arab desert environment that is worth conserving?".

Other important factors that contributed to such an attitude among decision makers as well as the general public was the overwhelming cultural heritage of Arab countries, particularly in countries such as Lebanon, Syria, Egypt and Tunisia. It was said that if spending on nature conservation has to be justified as an asset for tourist attraction, our monuments are quite enough and we should spend money on enhancing the attractiveness of our historic monuments

known by the whole world rather than on nature reserves of dubious value as touristic assets, because of their meagre wildlife content, if compared with the richness and attractiveness of East African National Parks. As tourist attractions, any national park in any Arab country (with the exception perhaps of the Sudan), could never compete with those of Kenya or Tanzania, it was said.

In spite of this resistance, several Arab countries participated in the first ever attempt at protecting nature in the region, by attending a UNESCO meeting in Beirut in 1955. Ecologists continued to study the desert environment, its flora, and its fauna, regardless of the prevailing negativistic attitudes. In 1968, Arab North African countries signed, with other African countries, the Algiers Treaty for Conservation of Nature and Natural Resources under the umbrella of the Organization of African Unity (OAU). And then came the Stockholm Conference in 1972, which ushered in a new era of environmental awareness and of understanding of conservation needs in the region.

Characteristics of biodiversity in Arab countries

In the following lines we shall try to give a brief summary of the characteristics of biodiversity in Arab countries, with special emphasis on its origins, its value, and its conservation.

Origins of biodiversity in the Arab region

The geographical position of Arab countries has had an important role in the intermediate nature of their biodiversity. The Old World's biogeographic regions are four:

1- The Palaearctic Region, extending from the Iberian Peninsula to the Far East from west to east, and from the Arctic to southern Europe, but also the Atlas Mountains in the Maghreb, a narrow strip along the Afro-Mediterranean coast from southern Tunisia to the Palestinian coast, and the western parts of Lebanon and Syria, as well as northern Iraq.
2- The Ethiopian Region, constituting Africa south of the Sahara, plus Yemen and Madagascar.

3- The Oriental Region, extending from Oman to South East Asia, and separated from the Palaearctic Region by the Caucasus and Himalayan Mountain chains.
4- The Australasian Region, constituting Australia, New Zealand, and the Pacific Ocean Islands.

Arab countries are bordered by the Palaearctic from the north, the Ethiopian from the south, and the Oriental from the east. The Oriental Region has limited extensions into the inner lands of Iraq, Syria, Palestine, and Jordan. The Ethiopian Region also has some obvious extensions into the Tibesti and Hoggar Mountains in the middle parts of the Great Sahara Desert, in southern Libya and in southern Algeria, as well as in southern Morocco, besides its extension into northern Sudan. Naturally, Mauritania, the Sudan, Djibouti, Somalia, and the Comores, belong to the Ethiopian Region. The lands of eastern Yemen and western Oman represent the separation between the Ethiopian and the Oriental Regions.

The Sahara Desert, and its extension into the Arabian Peninsula, is a meeting place of elements from the Ethiopian and the Palaearctic Regions, with some rare intrusive elements from the Oriental Region, in varying combinations. It can thus be considered a transitional region, where elements may mix together, but it is considered neither a distinct biogeographic region nor a region divided among all three neighbouring regions.

If the Arabian desert is not a distinct biogeographic region, its biodiversity is certainly distinct just because it combines biotic elements from three different and distinct biogeographic regions. This is a unique phenomenon not met with elsewhere at the frontiers of other biogeographic regions. The Palaearctic Region is more or less sharply separated from the Oriental Region in Middle and East Asia. Likewise, the Oriental Region is also more or less sharply separated from the Australasian Region by the famous Wallacian line, and the Nearctic Region is sharply separated from the Neotropical Region in North America. Only in the Arab region do we find a very large region of mixing of co-existing elements from three highly spacious biogeographic regions. This is why the biodiversity of Arab countries is so important, and why it is rich and varied in spite of the small absolute numbers of species, relative to other regions in the north (in Europe), in the south (in tropical Africa), or in the East (in the Indian sub-continent). It is from this unique varied mixture of plants

and animals that Neolithic man in the Arab World drew the plants and animals which he domesticated, and which were spread from the Arab World to all other parts in the neighbouring biogeographic regions, and also to the New World.

Species living in the Arabian deserts are species that have been naturally selected from the pool of species of the three neighbouring biogeographical regions, that occupied these lands in earlier times, and that have become adapted over millions of years to the prevailing harsh desert conditions. There are also many species that have become isolated for such a long time that they have evolved into new species that have remained in the very small spots where they evolved, i.e. they have evolved into unique endemic species of very limited distribution. The longer the isolation of these spots is, the more likely we should expect to find endemic species therein, provided of course that they survive till we find them.

It has been found from earlier biogeographic studies that certain Palaearctic species exist in North African oases, away from the Mediterranean coast, such as in some oases of northern Libya and northern Egypt, and even as far south as Bilma Oasis in Chad, and in the Tibesti and Hoggar. Some Ethiopian species, on the other hand, are also found in the oases of northern Egypt and northern Libya, very near to the Mediterranean coast. It is noteworthy that most of the Palaearctic species that succeeded in reaching the middle of the Sahara are terrestrial. The possible exception may be the amphibians of Morocco, which are all Palaearctic (Pasteur and Bons, 1959), and a few semi-aquatic oligochaetes. By contrast, most Ethiopian species that succeeded in penetrating the Sahara and in reaching the Mediterranean coast are aquatic, such as in the case of oligochaetes (Ghabbour, 1996 a & b) and dragonflies (Dumont 1980), which will be discussed further on in some more detail. This success was due to the use of the Nile stream as a migration route from south to north, as well as the occurrence of long periods of high rainfall during the Pluvial Periods of earlier geologic periods, such as in the case of the dwarf crocodiles of the Hoggar. But Ethiopian terrestrial animals also did migrate far into the north, such as the African cheetah which was discovered a few decades ago in the Qattara Depression in northern Egypt, and is also found in Libya, Algeria, and Morocco, but not in Tunisia. North African cheetah populations are completely isolated from those in Central or East Africa.

In the case of plants of the steppe belt of the northern Sahara, Le Houérou (1995) remarked that these have two main centres rich in endemic species, the first in Egypt and Libya, and the other in Algeria and Morocco, separated by the desert of Syrte, where the Sahara touches upon the sea coast. Most of the plants of the North African desert came to it along terrestrial bridges connecting it to the neighbouring lands. We can distinguish Irano-Turanian elements from the east, Deccan elements from the south-east, African from the south, Andalusian from the north-west, Sicilian from the north, and finally Euro-Alpine elements from the north-east. North African desert plants comprise about 55% of Mediterranean origin, 35% of tropical origin, and the rest of Asiatic origin (Le Houérou, 1995).

The same aspect is observed about animal life. The Asiatic bear, lion, and auroches, existed in Syria and Palestine in historical times, and the wolf may have crossed occasionally into Sinai, but many reptiles of Asiatic origin populate the Eastern Desert of Egypt. At the same time, many Ethiopian species extend in Egypt along the Red Sea mountain chain to as far as Suez in the north, and penetrate into Palestine along the Wadi Araba, which is an extension of the Rift Valley and is almost totally populated by Ethiopian species. The question now is how and when did the migrations of plants and animals from outside the Arab World come into it? To answer this question, we must look into the rather recent palaeoclimates and the geological history of the Arab World in general and of North Africa in particular. Because this question has been discussed elsewhere (Ghabbour, 1996 a & b), it is mentioned only briefly here and the reader is referred to these papers for more detail.

In order to find out how the species of plants and animals presently existing in the Arab World reached the sites where they are found now, we must go back to the relatively recent geological past of the region and the succession of Pluvial and Inter-pluvial Periods that occurred in it since the Miocene. Scientists can now distinguish between two types of fauna in the Ethiopian Region of Africa south of the Sahara; the forest fauna and the savannah fauna, which is apparently more recent in its origination. During the Miocene Period (25 million to 12-15 million years ago), the equatorial rain forest covered most of Africa. This great forest extended into the Arabian Peninsula, India, and south east Asia in one continuous and homogeneous unit. Thus plants and animals were almost similar all through this immense space. This is the

explanation for the similarity of many species of the Ethiopian and the Oriental biogeographic regions, where we can see similarities in elephants, leopards, rhinoceroses, hippopotami, related primates and higher apes, etc.

The pluvial conditions of the Miocene and the early Pliocene were followed by dry conditions, and much of the rain forest disappeared so that the fauna of African forests was isolated from that of the Asian one. But this Pliocene dry period did not last for a long time and was followed by another rainy period, whereby the rain forest started to extend again. These changes did not affect only mammals, but also other vertebrates and the invertebrates as well. With the end of the Pliocene, about two million years ago, great changes in the global climate occurred, resulting in the famous four Ice Ages, which ended about 20,000 to 11,000 years ago. These four Ice Ages (Glacials), and the Interglacials which alternated with them, coincided with a number of Pluvial and Inter-pluvial periods, exceeding four, in the Middle East and North Africa, and these climatic vicissitudes explain the present day distribution of the flora and fauna of North Africa and the rest of the Arab region (cf. Claudsley-Thompson, 1969).

Several species of plants and animals migrated from Europe to North Africa and to the Levant, to escape glacial conditions. The formation of the ice sheets in the boreal latitudes resulted in a general global cooling of climate by about 5°C, higher rainfall in some parts, and a lowering of sea levels. The climate of the Arab World was therefore more or less similar to the climate of southern Europe now, and its shore lines were more extended, so that land bridges across the Mediterranean appeared and facilitated plant and animal migrations. The Saharo-Arabian desert is believed to have been a large grassland which allowed easy intermingling of European, Asian, and African biota. It enabled the former to reach the Tibesti and the Hoggar Mountains, and the latter to reach the Mediterranean coast. It is certain that the Pleistocene-Holocene Pluvial periods, coinciding in a way with the last (Würm) Glacial were of much more limited effect than those of the Pliocene, as shown by the map of distribution of fossils of large mammals of the Neolithic period (Allard-Huard, 1994), which does not go northwards beyond the Tropic of Cancer, except in Fayoum and Cyrenaica, helped evidently by being carried by the Nile into the Mediterranean. This indicates that even during the supposedly relatively wet Neolithic period, conditions for the fossilization of larger mammals were not favourable north of

the Tropic of Cancer, and that whatever rainfall there was, was due to the summer monsoon rather than to the winter Mediterranean rainfall regime. Moreover, it must also be concluded that the large number of desert biota wonderfully adapted to desert life in the Arab region must have been there since the very long Pliocene and perhaps earlier, and not just from the relatively shorter Pleistocene Inter-pluvials.

The hot spots concept

The concept of "hot spots" becomes of utmost importance in the context of Arab countries for the management of their biodiversity resources. There are several definitions for the term "hot spots" depending on what is needed by the person (or organization) using it. Here, we shall adopt the simple working definition given by Myers (1990), which he assumed could serve as a key contribution to conservation strategies. This definition is as follows:

Hot spots are areas that

(a) feature exceptional concentrations of species with high levels of endemism, and
(b) face exceptional threats of destruction.

It would be preferable to add, in the case of Arab countries, every spot where there are threatened habitats or species. In fact, every spot with greenery in Arab countries, is practically a hot spot, and an endangered hot spot for that matter.

Identification of areas to be protected requires setting priorities and listing areas of high and not so high biodiversity, in an order of urgency, showing which are to be earmarked for immediate protection and which can be left to wait for a while. After completion of literature surveys, of museum specimens, and of exploratory field excursions, GIS systems will provide opportunities to manage the large amounts of data that are necessary, and that are stored and manipulated in a suitably structured data base. Through a series of overlay maps, data can be manipulated to show:

1- areas of high species concentration,
2- of endemism,
3- rare species,
4- unique habitats, and

5- risks, their locations, their types, their intensities, and their imminence.

One recently suggested methodology is through GAP analysis (Scott *et al.*, 1993), whereby areas can be identified that can serve as preserves for biological diversity. A series of smaller preserves are thought of as to be as maintaining biodiversity in one large preserve, especially if they are connected by corridors. Preserves must be selected to protect biodiversity for long periods in the future (Anderson *et al.*, 1993). Preserving maximum biological diversity in a given biological domain will require a reserve network which includes every possible species for the longest period of time. This is called "permanent protection". In this methodology algorithms are used that define the smallest number of sites which would include all the species to be preserved (Margules *et al.*, 1988).

From the viewpoint of biodiversity conservation in Arab countries, a few remarks may be added to this approach. It is needless to emphasize or to repeat that the Saharo-Arabian desert is an immense hot and dry arid area, the largest of its kind in the world. This desert may be poor in absolute number of species, but they have two remarkable features:

1- Those species that are present and which have survived for thousands, perhaps millions, of years, are certainly very hardy and can tolerate extremes of temperature, from below zero to more than 50°C, and water availability from complete desiccation to inundation. Such extremes are not met with by other species in other biogeographic regions.
2- Desert species may be few, but they are certainly of an exceptional quality. They produce many substances of secondary metabolism that help them in their adaptations. They were the pool of most of the domesticated plants and animals upon which the world economy now depends, and the wild relatives still exist in some hot spots. Because of their economic value, it is popularly said that they are good either for food (if not poisonous), or for medicine (if they are).

Species in the Saharo-Arabian desert may be fewer than elsewhere, but they are of an exceptional quality. Therefore, the *problèmatique* of biodiversity conservation in Arab countries should be formulated as one of quality rather than of sheer numbers, as usually done for other regions of the world. We should think of numbers of species threatened as related to total number of

species present and of their quality, and number of habitats threatened as related to number and quality of habitats suitable for life. The loss of say 10 species in a desert habitat with 100 species is 10%, equivalent to the loss of 400 species in a tropical forest with 4,000 species. Unfortunately, international organizations may be quite alarmed at the loss of 400 species in the Amazon forest, but not at the loss of 10 desert species, although the two cases are equivalent. The sudden and instantaneous loss of 400 species in the Amazon forest, out of say 4,000 (10%), may be unlikely, and even if it happens, it will not be destructive to the forest ecosystem, but the irreversible loss of 10 desert species, out of 100 (also 10%), is highly likely, and very destructive. Desert species are already too few and too precious for us to let them disappear.

Wherever there is "land reclamation", tourism development, even safari rallies, and such sweeping changes in the landscape, there are hundreds of desert species and scores of habitats threatened by disappearance as a result of such irresponsible and inattentive activities. Based on this, every part of the Saharo-Arabian desert where there is plant and animal life is, in a sense, a hot spot that needs protection. Let us also emphasize that date-palm-grove oases are particular habitats where very ancient life styles and traditional ways of managing their agro-ecosystems are still being practised, and that their associated biota are thus conserved (Barakat, 1995), until they are noticed for "development projects" which begin by destroying the palm groves themselves, and consequently their dependent biota and soil formations. We can easily identify hundreds of habitats in the Saharo-Arabian desert coveted by "investors" in this way. As a matter of fact, every spot where a plant grows in the desert is theoretically a hot spot. It indicates where life can exist and where the prerequisites of life are available: water, good soil, plants, animals, as well as man and human society itself. Investing in such spots would be easier, less expensive, more attractive for staying, more durable, and with better profit. This is why where any vegetation is seen growing in the desert is expressly where "investors" go first with the purpose of reshaping the landscape, whether it be for housing, for recreation, or for agriculture.

However, simply for practical reasons, the hot spots concept should be by priority applied in our region to include all desert areas where the threat of so-called "development projects" is imminent. One such area is Bahariya Oasis in Egypt, 350 km south west of the Pyramids of Giza. This oasis harbours (or

perhaps used to harbour), a species of a large aquatic oligochaete (a relative of earthworms, but living in mud under water), called *Alma nilotica*, discovered in the Nile in 1855 and in Bahariya Oasis in 1971 (Ghabbour, 1976). It exists only in the Nile Valley between the Delta and Khartoum, and is one of 12 species of the genus spread in tropical Africa (Jamieson and Ghabbour, 1969). The occurrence of *A. nilotica* is the only record of its presence outside the Nile Valley. A recent article on the status of Bahariya Oasis of a journalistic but rather sympathetic accent appeared in the Cairo English language monthly *Egypt Today*, designed for the Anglophone community in Egypt, and for tourists who might find the information useful. The author (Stephens, 1996) says: "Bahareya is an Oasis of simple pleasures and sheer beauty, but its days as an untamed desert destination may be nearing their end". According to the author there are now three hotels and a fourth soon to be completed, this one a 4-star hotel and health resort. There are also at least two local "tour operators" ready to take tourists anywhere around. One of the hot springs is practically infested by bathing tourists, who complain of the "slippery" algae. These springs and their slippery algae are ironically the spots where are found aquatic animals that can throw by their presence much light on the ancient connection of this oasis with the Nile.

Another dramatic occurrence is the case of *Chuniodrilus ghabbouri* discovered by the present author in the Dahshur marshes a few kilometres south of the Pyramids of Giza in 1961, and recollected in 1966 (Jamieson, 1969). Its congeneric species are found only in West Africa. The area of Dahshur used to be a closed reserve for the Shooting Club of Egypt, for shooting migratory waterfowl, but is now overwhelmed with roads, factories, camping sites, and what not. Such occurrences are not only to be preserved just for the sake of preserving biodiversity, but also because the irreversible loss of these and similar species without their presence being even detected will make us lose forever invaluable information about them. We will by this loss lose evidence about past climates, their change (a very contemporary issue), past hydrology, and an insight into the probable amounts of rainfall during the Pluvial Periods, and hence knowledge about underground water reserves (Ghabbour, 1991; 1996 a).

Such knowledge would undoubtedly be very helpful for the rational development of these resources, so that maintaining biodiversity in deserts does

not only satisfy a biological curiosity, but does eventually boost development efforts.

Because most of the Sahara is barren, its plants and animals are naturally restricted in their distribution to the rare wadis, oases, wetlands, etc. The density of species, or "areal species richness", when calculated for the whole desert, will be of course very small (Cailleux, 1953), but if calculated as related to the area of the few and limited hot spots, it will certainly be quite astounding. As a matter of fact, where there are wild plants and animals in the desert is where Man and his domestic plants and animals can survive, settle, and live. If only because of this role as indicators for human development (both social and economic), hot spots and their biota are invaluable for their innumerable economic uses that desert people are quite aware of, a knowledge which we risk losing very quickly. Consequently, the search for hot spots must be intimately linked to the search for indigenous knowledge about the wild plants and animals inhabiting them. One of the renowned indigenous herbalists in the St. Catherine area in southern Sinai, has said how sad and how frustrated he is that his two sons both refuse to learn his profession from him, preferring other occupations, and that he is having great difficulty convincing other young men to become his apprentices and to pick up his knowledge ("Dr" Ahmad Mansour, personal communication, 31 May 1996; Halim, 1996).

Where are hot spots? What is threatening them?

When the last Glacial subsided (more or less coinciding with the Neolithic period of human cultures), and the Saharo-Arabian desert became dry, such plants and animals could survive and continue to reproduce only in spots having either permanent water, such as in oases, or enough moisture, such as mountain tops. These are the *refugia* of the Arab World's biogeography, and their biota should now be regarded as "relict" species, i.e., cut off from their main populations in their original homes. Some of them evolved in these *refugia* into new species, peculiar to these spots, and found only there, i.e. endemic, and at the same time rare, species, that need to be first recognized, and then conserved and studied. Their presence, and their discovery, throws much light on the past history of the Arab region and its palaeo-ecology, as was the case with earthworms, whose endemic species in the oases within the Sahara desert of North Africa, and the possible routes and periods of entry of

their ancestors into these oases, have shown the probable amounts of rainfall in the period 140,000 to 70,000 years ago (Ghabbour, 1996 a & b).

Bousquet (1992) has drawn a longitudinal transect between Algeria and Nigeria, across the western part of North Africa, whereby it can be seen how larger mammals are distributed along the transect, and how the number of their species (absolute diversity), is thinned out in the middle distances between the Mediterranean and the Sahel. Areas where the few large mammals exist in-between these two regions should be considered as important potential hot spots, that should be earmarked for conservation. Biodiversity hot spots should not be limited to the biota consisting only of the local resident species, but must include migratory species as well. Hot spots in the western part of the Arab World that serve as resting stations for migratory birds of the Western Palaearctic, also need attention (Bousquet, 1992), as well as those in Egypt and other spots of resting stations for migratory birds from northern and central Europe in the Middle East.

However, no matter how much it may be important to conserve hot spots related to mammals and birds (as they are more conspicuous and attractive in the public eye), attention should also be directed to hot spots related to invertebrates, which constitute about 95% of the Animal Kingdom. Desert invertebrates deserve protection as agents of soil fertility, natural enemies of pests, pollinators of crops and of natural vegetation, among other ecosystem functions. Their unique and unusual physiological adaptations to heat and drought, in spite of their small sizes (cf. Vannier and Ghabbour, 1983; Ghabbour *et al.*, 1991, on the sand roach *Heterogamia syriaca*), make them potential sources of hormones and other drugs to cure human ailments.

Already some vertebrates, e.g. the fat sand rat *Psammomys obesus*, are being massively collected by some European drug companies from North African deserts, without any controls or regulations, for medicinal purposes. There is no information available, unfortunately, about the highly probable hunt for the sand roach, after publication of our scientific papers about its adaptations to heat and drought, and the interest shown in it by a certain European drug company.

Aniskowicz (1995) suggests that the protection of invertebrates should follow three steps:

1- identify non-vertebrate species at risk,
2- protect these species and their habitats, and
3- establish a central data base to assist in the two preceding tasks.

Efforts of Arab countries

Although conservation of wild plant animal species and of their habitats was practised in Arab countries, and was regulated by common law, more than 15 centuries ago, recent social transformations have two important effects on the present situation concerning biodiversity:

First, the old protection systems need to be modernized, and this in the direction of willful improvement of protection measures, and second, urban expansion, land reclamation for agriculture, and industrialization, together with the need for practising old style aristocratic types of recreation, such as falconry, let alone the indiscriminate use of firearms and mechanized hunting, have together a tremendous negative impact upon biodiversity.

The oil riches of a number of Arabian Gulf countries have induced some members of their aristocracy into organizing huge mechanized hunting expeditions roaming the deserts of their own countries first, and then of neighbouring countries offering them hospitality, by way of traditional fraternity, and almost decimating their falcons, their gazelles, and their bustards. Some Arab countries have suffered so much from these expeditions that a number of their desert mammals and birds can be considered practically extinct. And of course, the rare species disappear first. Recent reports indicate that the various species of desert truffles are facing the danger of extinction, or extreme rarity, because of over-exploitation.These mechanized hunting expeditions are resented by national conservationists and a number of journalists of the concerned countries at both ends, who spare no effort to denounce them and their practices, but with little or no success. Some efforts for breeding endangered species in captivity, such as the bustards, are being carried out in a number of Gulf States. The case of the Arabian oryx is at least a bright success story that needs to be repeated elsewhere.

In 1968, African countries, including Arab countries situated in Africa, signed in Algiers the African Treaty for Conservation of Nature and Natural Resources during a Summit Meeting of the Organization of African Unity.

Although this Treaty needs much revision in the light of modern knowledge and modern concepts, it could have served to improve environmental conservation in the signatory countries had it been given due attention, but the fact is that it is unfortunately very little known worldwide and by some of the signatory countries themselves. It has of course been superseded by other later international conventions, especially by the more famous Biodiversity Convention of Rio 1992, but it deserves to be revised and modernized as a tool for regional African co-operation, besides the Rio Biodiversity Convention. Arab countries badly need a similar regional tool under the aegis of the Arab League or of ALECSO.

The Convention on International Trade in Endangered Species of Wild Flora and Fauna, known as CITES, has been adhered to by Algeria, Egypt, Jordan, Morocco, the Sudan, Tunisia, and the United Arab Emirates, i.e. only seven countries (J. Berney, CITES Secretariat, priv. corr., 8 June 1995).

The World Heritage Convention, which is concerned with both cultural and natural heritage sites, is less implemented in the Arab States than in other regions of the world. Although Algeria, Bahrain, Egypt, Jordan, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, and Yemen (15 countries), have signed the Convention at a very early stage, only four natural heritage sites from these countries figure on the World Heritage List. Eight biosphere reserves are registered and a number of Ramsar sites are listed in six contracting State Parties. Some of the sites such as Ichkeul in Tunisia, Tassili-n-Hoggar in Algeria, or Banc d'Arguin, are listed under all three programmes, or at least in two of them (Rössler, 1996)

Concerning the main Biodiversity Convention, all Arab countries have signed it, with the exception of Saudi Arabia, Somalia, and Syria (Batanouny, 1996).

Let us now see what Agenda 21 says about biodiversity It is a document seldom given attention, in spite of its value.

The proposals of Agenda 21

Agenda 21, approved in the Rio Summit, but rarely referred to as a binding document, gives governments and scientists valuable guidelines for actions that would support the application of the Biodiversity Convention and improve its

efficiency. The Agenda pointed out in Chapter 15 that factors leading to the loss of biodiversity are a serious threat to human development, and attributed the global loss of biodiversity to:

1- habitat destruction,
2- over-harvesting,
3- pollution, and
4- the inappropriate introduction of foreign plants and animals.

Proposals in Agenda 21 for conserving biodiversity called on governments to:

1- press for the early entry into force of the Biodiversity Convention,
2- foster traditional methods and knowledge of indigenous people and their communities,
3- share the benefits of biological resources, including biotechnology, in particular with developing countries, and
4- develop national strategies for the conservation of biodiversity, the sustainable use of biological resources and the safe transfer of biotechnology, particularly to developing countries.

The Agenda added that national surveys should be undertaken in order to:

1- compile an inventory of biological resources,
2- improve scientific and economic understanding of the importance and functions of biodiversity, and
3- suggest priorities for action.

Moreover, the Agenda proposed that:

4- the economic and social implications of protecting biodiversity should also be assessed,
5- a global network should regularly monitor, update, and report this information,
6- environmental impact assessments should be made for development projects likely to affect biological diversity,
7- economic incentives should be used to encourage the conservation of biodiversity and sustainable use of biological resources,
8- conservation of biodiversity should occur through *in situ* conservation of ecosystems and natural habitats and *ex situ* measures, preferably in the country where the species are found,

9- the rehabilitation of damaged ecosystems and endangered species should be promoted,
10- sustainable practices in areas adjacent to protected areas should be encouraged, and
11- technical and scientific co-operation should be promoted, with special attention given to technology transfer, professional training programmes, and developing research and management facilities such as herbaria, museums, gene banks, and laboratories.

Of course, very few of these proposals have been implemented for various reasons, the most obvious of which is the inability of governments, particularly in developing countries, to implement all of these proposals at the same time. National biodiversity strategies should not only look into conservation, but also into identifying threats and laying down the foundations of implementing these proposals over a reasonable period of time, say 20 years from now.

Arab countries, having signed the Biodiversity Convention in their majority, like many other regional country groups all over the world, have taken up steps to apply the Convention and to co-ordinate their actions accordingly.

Collectively, there are several international umbrellas, notably IUCN, UNESCO-MAB, and WHC, under which Arab countries are co-operating for environmental issues in general and for biodiversity conservation in particular. At the regional level, the Arab League has established, in co-operation with UNEP and UNDP, the "Joint Committee on Environment and Development in the Arab Region", which deals with biodiversity issues among other aspects related to sustainable development. The Arab League Educational, Cultural, and Scientific Organization (ALECSO), which is to the Arab League what UNESCO is to the United Nations, has a programme dealing with biodiversity in Arab countries. At the sub-regional level, the Gulf Co-operation Council (GCC), also has put biodiversity on its agenda. In the period 1993-1995, Arab countries participated in 16 regional meetings for discussing biodiversity conservation (Ghabbour, 1995; Batanouny, 1996). These were:

1- The West Asia/North Africa Regional Members Group Meeting, Amman, Jordan, June 1993,
2- Workshop on Biological Diversity in North Africa, Tunis, Tunisia, Nov. 1993,

3- The West Asia/North Africa Regional Members Meeting, Buenos Aires, Argentina, Jan. 1994,
4- Workshop on Biological Diversity and Education in North Africa, Rabat, Morocco, May 1994,
5- Genetic Resources, an Egypt/United States Workshop, Cairo, Egypt, June 1994,
6- Workshop on Biological Diversity in Gulf Co-operation Council Countries, Kuwait, Sept. 1994,
7- Workshop on Arid Lands Biodiversity in North Africa, Cairo, Egypt, Nov. 1994,
8- Second Regional Meeting of National Arab MAB Committees, Cairo, Egypt, Dec. 1994,
9- Meeting of NGOs in Mediterranean Countries for Coastal and Marine Biodiversity in the Mediterranean, Alghero (Sardinia), Italy, Jan. 1995,
10- Workshop on Rural Women, Biodiversity, and Development, Marrakech, Morocco, Apr. 1995,
11- Third Training Course for Management and Conservation of Natural Heritage in the Arab World, Cairo and Sinai, Egypt, May/June 1995,
12- Thirteenth Session of the UNESCO-MAB International Co-ordinating Council, Paris, France, June 1995,
13- Riyadh Conservation Forum, Riyadh, Kingdom of Saudi Arabia, Oct. 1995,
14- Meeting of Arab Experts on Biodiversity, the Arab League, Cairo, Egypt, Oct. 1995,
15- Workshop on Biodiversity, Izmir, Turkey, Oct.-Nov. 1995, and
16- Workshop on Biological Diversity, its Causes and Sustainable Use in the Arab World, Bahrain, Dec. 1995.

This is certainly an impressive list of efforts exerted by Arab countries for the conservation of their biodiversity. In addition, there are two on-going projects for the study of the situation of biodiversity and for its conservation in Arab countries; one is internationally sponsored but of a sub-regional character, and the other is regionally oriented and regionally sponsored. The first is an IUCN-sponsored project, supported by the Swiss Government, and the second is sponsored by ALECSO (headquarters in Tunis).

The IUCN-sponsored project concerns the five countries of North Africa: Morocco, Algeria, Tunisia, Libya, and Egypt. It has four components: Biodiversity Conservation (Hot Spots), Medicinal Plants, Biodiversity Education, and Conservation of the Cheetah. The project is organized on the basis of a regional co-ordinator and five national co-ordinators for each sub-project. A regional meeting for co-ordinators of the Hot Spots sub-project was held in Tripoli, Libya, in July 1996 (Ghabbour, 1996 c), and another one in Cairo in February 1997.

UNESCO is also contemplating, with the collaboration of National Arab MAB Committees, establishing an Arab MAB network, with one of its main activities suggested as the promotion of biodiversity research and education in biosphere reserves. Two meetings of Arab National MAB Committees were held for this purpose, one in Damascus, Syria, in December 1996, and the other in Amman, Jordan, in June 1997.

Furthermore, the International Convention concerning the conservation of the world's cultural and natural heritage, which was convened under the patronage of UNESCO, and which established the World Heritage Centre to promote its implementation, under the aegis of UNESCO, is trying to promote the establishment of natural heritage sites in Arab countries. One of the criteria is that the site should be representative of a unique and threatened community of plants and animals. There are at present only four declared natural heritage sites in Arab countries, compared to 41 cultural sites (Ghabbour, 1997). The World Heritage Centre has also organized, between 1989 and 1997, four training courses on the conservation and management of natural heritage sites in Arab countries.

The ALECSO project, entitled "Promotion of Arab Co-operation in Biological Diversity", is of a wider scope. It aims at defining the present situation of biodiversity in Arab countries with a view of helping them to establish national, sub-regional, and regional strategies for the conservation and sustainable use of biodiversity, in accordance with the commitments of the Biodiversity Convention and the guidelines of Agenda 21.

The ALECSO project objectives (ALECSO 1994) are:

1- the initiation of a survey of the status of biodiversity in Arab countries, and

2- assistance in the preparation of national strategies for its conservation and the sustainable use of biological resources.

The outputs expected from this project are:

1- the elaboration of a study report on the status of biodiversity in the Arab World,
2- the study report should reveal the status of species, habitats, and ecosystems in each country in the Arab Region,
3- the study will recommend formulation of strategies or programmes of action for the conservation of biological diversity and the sustainable use of biological and genetic resources in the Arab States,
4- the study will generate understanding of the importance of the protection of biodiversity and its relationship to sustainable development among decision makers and the general public,
5- the strategies and action plans which will be treated in the study will contribute to the implementation of the Biodiversity Convention,
6- the study will formulate priorities which will assist in strengthening regional and international co-operation in the conservation of biodiversity,
7- the study is expected to lead to the establishment of Arab national and regional networks for the exchange of data relevant to the conservation of biodiversity and the sustainable use of biological and genetic resources,
8- the study is expected to identify priorities related to the strengthening of national capabilities through human resource development and institution-building in the area of biodiversity conservation, and
9- the study will also identify ways and means which would assist in meeting the actual costs needed in the implementation of biodiversity projects, and
10- the elaboration of an Arab Regional Biodiversity Strategy, as a final objective for this phase.

The first step of the ALECSO project was to formulate a questionnaire built upon the issues evoked in international literature on the subject (WRI, 1992; WCMC, 1992), in order to facilitate inter-regional comparisons. The questionnaire was sent to national experts in Arab countries. Responses from 20 experts belonging to 15 Arab countries have been received and processed.

The second step was to carry out a critical analysis of the responses to these questionnaires, produce a report, and discuss the report in a meeting of these experts that was held in October 1996 in Beirut, Lebanon. The questionnaire included, among other things, questions about global and specific threats to biodiversity and to habitats in the concerned countries.

Results of the ALECSO questionnaire

Threats to habitats (including vegetation)

From what has come in, we can summarize the general threats to biodiversity and to its habitats in Arab countries (which are practically also threats to the vegetation cover), as follows:

(The number of countries whose experts mentioned the threat are given for each type of threat for each component of biodiversity in Arab countries, between brackets. The threats are arranged in descending order according to the number of experts mentioning them as such. Threats receiving three positive responses or less are not shown.)

1- urban expansion (10),
2- overgrazing (9),
3- pollution (8),
4- desertification (8),
5- agricultural expansion (7),
6- overpopulation (6),
8- overfishing (6),
7- drought (4).

Wildlife in general

1- destruction of vegetation (10),
2- habitat destruction (10),
3- overhunting (6),
4- pollution (6).

Wetlands

1- drought (10),
2- drainage (9),
3- sanitary drainage (9),
4- mosquito control (8),
5- canalization (7),
6- barrages (7),
7- fish farms (6),
8- solid waste disposal (5),
9- road making (5),
10- extraction of underground water (5),
11- erosion (5),
12- sea level rise (4).

Most significant specific threats to various animal groups were perceived as such:

Mammals

1- habitat destruction (14),
2- inadvertent interference (13),
3- overhunting (9),
4- agricultural expansion (9),
5- destruction of vegetation (6),
6- fire (6),
7- international trade (5),
8- agro-chemicals (4),
9- mining (4),
10- epidemics (4).

Birds

1- inadvertent interference (12),
2- habitat destruction (11),
3- overhunting (11),
4- wetland drainage (10),
5- agricultural expansion (8),

6- agro-chemicals and pollution (7),
7- international trade (5),
8- destruction of vegetation (4),

Reptiles

1- inadvertent interference (12),
2- habitat destruction (10),
3- international trade (9),
4- agricultural expansion (7),
5- overhunting (7),
6- destruction of vegetation (5),
7- fire (5),
8- agro-chemicals and pollution (4),
9- wetland drainage (4).

Fishes

1- inadvertent interference (13),
2- habitat destruction (11),
3- overfishing (10),
4- agro-chemicals and other pollutants (7),
5- wetland drainage (7),
6- introduction of alien species (6),
7- international trade (4).

Invertebrates

1- inadvertent interference (9),
2- agro-chemicals (7),
3- habitat destruction (6),
4- wetland drainage (5),
5- agricultural expansion (4).

Institutional arrangements

Among the institutional arrangements in the 15 Arab countries from which answers to the questionnaire were received, it appears that only five countries

have gene banks, seven have botanical gardens, while nine have zoological gardens. Twelve of the countries from which questionnaires were received have between them no less than 23 natural history museums and/or referral collections of some animal groups, notably birds and insects, while only five have between them no less than 18 herbaria (the national herbaria of two Arab countries were sacked or went on fire in a recent war).

Legal aspects

One aspect related to institutional arrangements that is very easily overlooked is the question of who owns a country's plants and animals. In many societies private property is treated as almost sacred, and the owner of a property (land or buildings), is allowed almost absolute freedom to dispose of his property in any way he likes (with some limited constraints, of course). Governments, on the other hand, are usually keen on protecting their territories and their mineral resources, underground or in territorial waters. They usually do not allow their exploitation except after issuing strict laws, after hard negotiations, with firm supervision of exploitation operations, and the State gives concessions and obtains a percentage of the profit. Governments are also keen to protect their cultural heritage. If an archaeological artifact is found in a plot of private property, the owner of the plot has no right to possess the artifact, and may be prosecuted for keeping it to himself. This is not the case in any way when it comes to wild plants and animals. Any person can go to the desert and harvest its wild plants and animals, and do with them what he likes, without any legal constraints, except in very few Arab countries. The legal framework is therefore wanting in this aspect of protection of the natural national wealth of biodiversity, and it is necessary to consider legislators among the groups that have to be involved in protection and sustainable utilization efforts.

Scientific publications

There are more than a hundred major references and several hundred published scientific papers on the flora and fauna of individual Arab countries, some of them very recent, and produced with the encouragement of the Rio Biodiversity Convention, and with the co-operation of international organizations (UNEP, IUCN, UNESCO), and foreign centres of excellence.

But this is not the case for the totality of the Arab World, except for birds and insects, covering only a small number of contiguous neighbouring countries (e.g. the Maghreb countries, North Africa, the Levant). There are also about 10 scientific periodicals in five countries specialized in publishing scientific papers about their floras and faunas. Nine countries have governmental institutions preoccupied with the protection of biodiversity in one way or another. Eight countries have active and knowledgeable NGOs preoccupied with the same purpose.

Education, media, and the public

In spite of these efforts exerted at the level of scientists and the administration, biodiversity occupies a very small place in educational programmes, at school or at university level, and in the media, whether printed or electronic. It is ironic to note that while there are several media programmes that try to inculcate the ideas of nature conservation, there are simultaneously others, sometimes in the same television channels, which advertise the pleasures of hunting wild waterfowl in the country's wetlands, in order to attract tourists from foreign countries.

Role of women and youth

Much hope is attached among biodiversity specialists in Arab countries to the role of women and youth in promoting the conservation and sustainable utilization of biodiversity, but there is also an emphasis on the crucial role of trans-national corporations (TNCs), for collaborating sensibly in these efforts.

Conclusions

It can be understood from the foregoing and from the survey carried out by means of the ALECSO questionnaire, that the root of all threats to biodiversity in Arab countries is the lack of awareness about its value, and about what is going on in the international arena concerning efforts to conserve it and to utilize it in a sustainable manner. If all dangers that were enumerated as threats to biodiversity in Arab countries are serious, lack of awareness must be considered the most serious of them all. Those who know about biodiversity issues in Arab countries are very few indeed, and whether governmental or non-governmental, they have little in their capacities to stop the degradation of

biodiversity in their own countries. Although regional organizations such as the Arab League and ALECSO, and international organizations such as UNEP and IUCN, have programmes for the study and maintenance of biodiversity in Arab countries, in collaboration with their authorities, with their scientists, with the media, and with NGOs, these programmes are not powerful enough to reach the general public. Besides the need for binding national laws and sub-regional and regional conventions regulating the conservation of biodiversity and its sustainable utilization, it is only upon the understanding and the positive participation of the general public, together with the collaboration of neighbouring countries and the TNCs, that the biodiversity conservation movement can ever hope to succeed in achieving its aims.

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